Medical-surgical nurses need to be aware of the early signs and symptoms of sepsis and be prepared to start early goal-directed therapy before the patient is transferred to a critical care unit. The initial, life-saving treatments for sepsis do not require special skills or equipment and can help reduce patient mortality.

An 83-year-old woman presented to the emergency department complaining of nausea and lower abdominal pain. She was diagnosed with a urinary tract infection, started on IV ciprofloxacin (Cipro®), and admitted to the medical-surgical unit for observation. Four hours after admission, she became tachypenic and her oxygen saturation dropped from 96% on room air to 90%; she required 2 liters of oxygen per nasal cannula to maintain saturations of 94%. Her urine was cloudy and concentrated in the indwelling urinary catheter bag. Eight hours after admission, she became forgetful and the nurse documented that the patient was “hard of hearing,” even though she was not hearing impaired. The next morning, 12 hours after admission, her white blood cell count had increased to 25.3, her blood pressure had dropped from 122/68 to 98/55, and she had become tachycardic, more confused, and lethargic. The physician transferred the patient to the critical care unit (CCU) due to increasing instability. Within six hours of the transfer, the patient became unresponsive and was intubated. She was started on vasopressors with little response. Later that day, the family elected to withdraw support. Three hours later, the patient died.

continued on page 8

Contact hour instructions, objectives, and accreditation information may be found on page 11
Surviving Sepsis

This scenario is all too common for the septic patient. However, it can have a positive outcome when the signs of sepsis are recognized early and treatment is initiated in a timely manner. Sepsis can progress within a matter of hours to severe sepsis and then to septic shock, for which the mortality rates can be as high as 40% (Dombrovskiy, Martin, Sunderram, & Paz, 2007). Timely recognition and treatment is critical to survival, which is why many institutions have implemented the treatment bundles from the Surviving Sepsis Campaign in their critical care settings (Levy et al., 2010).

The development of sepsis frequently occurs outside of the CCU setting. Therefore, it is critical that medical-surgical nurses recognize sepsis, initiate goal-directed therapy, and facilitate rapid transfer to the CCU for further support and treatment. Robson and Daniels (2008) reported medical-surgical nurses have a poor understanding of sepsis and the earliest signs and symptoms of sepsis are difficult to detect. By increasing awareness of the problem of sepsis, medical-surgical nurses can begin to recognize the physiological trends in patients that could indicate sepsis so they may initiate effective treatment sooner and improve chances of survival.

The Challenge of Sepsis

The incidence of sepsis has been increasing, and that increase is expected to continue (Nelson, Lemaster, Plotk, & Zahner, 2009). As the population ages, the number of patients living with chronic conditions increases, the prevalence of infections with multiple-drug resistant organisms increases, and the chance that medical-surgical nurses will encounter sepsis increases as well (Angus et al., 2001). Mortality rates for septic shock range from 18%-40%. Mortality rates are difficult to precisely report; often the cause of death is reported as “respiratory failure” or “complications from pneumonia,” rather than sepsis (Dombrovskiy, 2007).

Sepsis has not always been considered a time-sensitive condition. Even when the diagnosis of sepsis was made, clinicians would often not act immediately on that diagnosis. There wasn’t an urgency to collect cultures or to administer antibiotics, and rapid transfer to the CCU was not always a priority for the septic patient. Treatment often wouldn’t be started until the patient arrived in the CCU. In 2006, Kumar and colleagues completed a study that changed the way sepsis was managed. The study demonstrated that for every hour that passed without administering antibiotics after the onset of hypotensive sepsis, the patient’s risk of dying increased by 7.6%. This indicates that just giving the first dose of antibiotic is not enough. The first dose of antibiotic needs to be given as soon as sepsis is suspected. Therefore, the medical-surgical nurse’s role in recognition of early sepsis and the initiation of treatment is critical to the outcome of the patient.

The Pathophysiology of Sepsis

Sepsis occurs when the normal, localized inflammatory response becomes systemic. The localized inflammatory response causes the vessels to dilate in order to bring more

<table>
<thead>
<tr>
<th>Table 1. Systemic Inflammatory Response Syndrome (SIRS)</th>
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<tbody>
<tr>
<td>Patients meeting any two of these SIRS criteria, plus a known or suspected infection, meet the diagnosis of sepsis.</td>
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<tr>
<td>Temperature &gt; 38°C or &lt; 36°C</td>
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<tr>
<td>Heart rate &gt; 90 beats per minute</td>
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<tr>
<td>Respiratory rate &gt; 20 breaths per minute</td>
</tr>
<tr>
<td>White blood cell count &gt; 12 or &lt; 4, or more than 10% bands</td>
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</tbody>
</table>

Note: Adapted from Bone et al., 1992.

white blood cells to the area to fight the infection. As a result, the area surrounding the site of the injury becomes red and warm. Capillaries become more permeable, releasing fluid and immune mediators into the area, leading to the surrounding area becoming edematous. This normal local response helps the body fight off the infectious agent. When the inflammatory response becomes systemic, these same changes in the vasculature happen throughout the body, and blood flow to the organs and tissues becomes quickly compromised (Steen, 2009).

Systemic vasodilation results in a drop in blood pressure as the intravascular volume becomes suddenly inadequate to maintain perfusion to tissues. The massive vessel dilation causes the body to ‘think’ it doesn’t have enough blood, so compensation and then deterioration begins. Tachycardia results as the body releases adrenaline in order to increase cardiac output and improve vascular tone. The capillaries become more permeable throughout the body, releasing inflammatory mediators that cause changes in the clotting mechanism and the development of microthrombosis. Microthrombus formation in the capillary beds decreases oxygenation to the tissues, resulting in a switch from aerobic metabolism to anaerobic metabolism in the cells, leading to a buildup of lactic acid in the tissues (O’Brien, Ali, Abergeg, & Abrahem, 2007). Lactic acid build-up produces a profound metabolic acidosis that further compromises the patient. The relative loss of circulating volume leads to decreased organ perfusion, which eventually leads to organ failure. It is the failure of one organ system after another that eventually leads to the patient’s death (Steen, 2009).

Recognizing Sepsis

Over the years, the diagnosis of sepsis has often been inconsistently applied (Nelson et al., 2009). The Surviving Sepsis Campaign provides clear definitions of the stages of sepsis as well as recommendations for treatment in each stage (Dellinger et al., 2008). The first step in recognizing sepsis is to identify a patient with Systemic Inflammatory Response Syndrome or SIRS (see Table 1). SIRS can occur for a number of reasons, such as from burns or pancreatitis, but when it is combined with a known or presumed infection, the diagnosis of
Changes in oxygenation. This is often one of the earliest signs that a patient is becoming septic (Robson & Daniels, 2008). As oxygen delivery to the tissues decreases, patients will try to compensate by increasing their respiratory rate. A patient's oxygen saturation may drop as the periphery experiences a decrease in oxygen delivery. The medical-surgical nurse may notice that a patient with cellulitis has increased his or her resting respiratory rate from 14 per minute to 18 per minute. The patient may now need 4 liters of oxygen per nasal cannula to maintain an oxygen saturation at 97%, whereas 4 hours earlier he or she only needed 2 liters of oxygen per nasal cannula (Whiteside, 2005).

Increased heart rate. As the patient's vessels dilate, the body attempts to keep cardiac output normal by increasing heart rate. This compensatory mechanism attempts to keep the tissues oxygenated and the patient may not appear as ill as he or she really is. Once the patient is no longer able to compensate, the pulse will start to drop toward normal, and the patient will begin to show signs of further deterioration.

Altered mental status. The brain is one of the most sensitive organs to changes in oxygen levels, glucose levels, and electrolyte levels. An altered level of consciousness can occur early in the septic process (Whiteside, 2005). Often the problem becomes one of recognizing what the change is and when it occurs. Establishing a neurological baseline for a patient is critical in being able to detect subtle changes in mentation. Clear, accurate, and precise documentation of a patient's neurological status helps medical-surgical nurses caring for the patient later to determine whether a change has occurred, especially in patients who have baseline confusion or other neurological deficits (Steen, 2009). For example, how often is it documented "alert and oriented x2" and the medical-surgical nurse wondered to which two factors the patient was actually oriented? Being more precise by charting, "alert to person and time, but not date," leaves no doubt and makes a change easier to detect (Nelson et al., 2009).

Decrease in tissue perfusion. The danger of sepsis is organ failure which results from prolonged tissue hypoperfusion. Detecting tissue hypoperfusion is easy when the patient's blood pressure appears profoundly low (e.g. 88/45), but is harder to detect when the blood pressure reading appears more normal (e.g. 110/43). The mean arterial pressure (MAP) is a far more sensitive indicator of tissue perfusion than looking at blood pressure alone, and it is easily monitored (Giuliano, 2007) (see Figure 1). A decrease in tissue perfusion will also be reflected in a decrease in urine output. Since urine output can be easily monitored, it should be monitored in all patients who are at risk of developing sepsis.

Treatment: The Sepsis Six

The Sepsis Six, interventions that do not require specialized staff or skills, are adapted from the 6-hour CCU sepsis resuscitation bundle and recognize that early recognition and treatment in areas outside of critical care can help more patients survive sepsis (Robson & Daniels, 2008). All of these interventions

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**Table 2.** Signs of Acute Organ Failure

| Cardiovascular | Pulse > 100 beats per minute  
|               | Dyshrhythmias  
|               | SBP < 90 mmHg or 40 point drop from baseline  
|               | MAP < 65  
| Respiratory   | Respiratory rate > 24 breaths per minute  
|               | O₂ Sat < 92% or increasing oxygen needs  
| Renal         | Urine output < 0.5mL/H  
|               | Increasing creatinine  
| Hematological | Elevated liver enzymes  
|               | Coagulopathy  
| Gastrointestinal | Ileus  
| Hepatic       | Thrombocytopenia  
|               | Coagulopathy  
|               | Increased D-Dimer  
| Neurologic    | Altered level of consciousness  
|               | Confusion  
|               | Psychosis  

*Note: Adapted from Balk, 2000.*
should be started within the first hour of recognition of sepsis and while awaiting transfer to the critical care unit.

Provide supplemental oxygen. Tissues being hypoperfused need to be able to get as much oxygen as they can from what is still circulating. Administering supplemental oxygen by nasal cannula, non-rebreather mask, or BiPAP will help ensure that the circulating volume is oxygen-rich as it can be (Whiteside, 2005). Supplemental oxygen helps slow the development of lactic acidosis from anaerobic metabolism. Oxygen should be administered to a patient goal of oxygen saturation being greater than 95% (Robson & Daniels, 2008).

Draw cultures. Blood cultures and cultures based upon the suspected source site of infection should be collected per physician order or protocol before the administration of antibiotics. The recommendation is that cultures be collected before the administration of antibiotics, but should not prevent the prompt administration of appropriate antibiotics (Dellinger et al., 2008).

Measure serum lactate. Metabolic acidosis can occur rapidly when tissues are forced into anaerobic metabolism (O’Brien et al., 2007). A serum lactate can help confirm suspected sepsis as the lactate can be elevated before the patient becomes hypotensive. Lactic acid levels can be used to further assess the success of goal-directed therapy. Sepsis resuscitation goals include a serum lactate level of less than 4mmol/L (Dellinger et al., 2008).

Start IV antibiotics. Perhaps the most crucial intervention is the administration of effective antimicrobial therapy within the first hour after the recognition of sepsis (Kumar et al., 2006). Hospitals can put order sets into place that help guide physicians in choosing the appropriate antibiotic for the presumed type of infection prior to having culture results. Many vital sign machines will automatically display the MAP. It is also easily calculated using this formula: SBP + 2(DBP)/3

Example: blood pressure of 110/43 = MAP of 65
blood pressure of 107/42 = MAP of 63

Note: Adapted from Giuliano, 2007.

Figure 1. Want to Know Where Your Patient Is? Check the MAP!

The MAP – Mean Arterial Pressure – is an indication of tissue and organ perfusion. Organs and tissues require a minimal pressure to maintain perfusion. MAP less than 65 mmHg identifies a patient at risk for tissue and organ hypoperfusion and eventual dysfunction and failure. The MAP is often a more sensitive indicator of tissue hypoperfusion than looking at blood pressure alone, because it takes into account the initial drop in diastolic pressure that occurs with the vasodilation of sepsis. Many vital sign machines will automatically display the MAP. It is also easily calculated using this formula: SBP + 2(DBP)/3

Example: blood pressure of 110/43 = MAP of 65
blood pressure of 107/42 = MAP of 63

Conclusion: You Make the Difference

The adoption of early goal-directed therapy outlined in the 6-hour and 24-hour bundles has increased the survival rate of septic patients who present to critical care areas (Kumar et al., 2006). Now it is time to increase awareness of sepsis in acute care areas of the hospital. Medical-surgical nurses are key in recognizing the early signs of sepsis in patients, promptly initiating treatment, and providing for the continuation of appropriate care by expediting transfer to the critical care unit.

References


Kumar, A., Roberts, D., Wood, K.E., Light, B., Parrillo, J.E., Sharma, S., ... Cheang, M. (2006). Duration of hypotension before initiation of effective antimicrobial therapy is the critical determinant of survival in human septic shock. Critical Care Medicine, 34(6), 1589-1596.
